POST AND RAILING CONSTRUCTION

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Related Applications

[0001] This application claims the benefit of the filing date of U.S. Provisional Application No. 60/400,294, filed August 1, 2002, the entire disclosure of which is incorporated herein by reference.

Field of the Invention

[0002] The present invention relates to post and railing assemblies, and more specifically to post and railing assemblies with standard prefabricated parts.

Background of the Invention

[0003] Post and railing fences have traditionally been constructed using a variety of timber, including pine and cedar. Although timber is a reasonably sturdy material, timber wears down over time, yielding to extreme weather conditions, prolonged rotting, termite infestation, and other factors. Even treated timber can experience rotting and warping. The development of polyvinylchloride (PVC) and other plastics has led to the use of plastics in post and railing assemblies. Although plastic railing materials are more durable than timber in many respects, known plastic railing systems have some drawbacks. For example, some plastic systems include a large number of fasteners and parts that make installation difficult and costly. In addition, many plastic railing systems include visible fasteners and seams that detract from the appearance of the railing system. The components in some plastic railing systems do not permit reliable or secure connections between components. Based on these drawbacks, there is a clear need for plastic railing systems that are economical to install, aesthetically pleasing, and securely constructed.

Summary of the Invention

[0004] A post and railing construction in accordance with the present invention permits construction of fences and railings from parts which are pre-molded from a resinous material such as rigid polyvinyl chloride (PVC). The parts require no

painting and are not prone to corrosion or rust when exposed to harsh environments. In addition, the parts are configured to be used on a number of different railing and fence assemblies.

[0005] In one embodiment of the invention, railings are supported on brackets mounted on posts. In another embodiment of the invention, railings are supported directly on the posts by routed openings in the posts. The present invention also provides an easy to assemble fence assembly having the appearance and style of a picket fence. Metal components that are used in the invention may be covered to avoid direct exposure to damaging elements, such as moisture. For example, the railing construction may be provided with covers that are placed over screws to protect the screws and hide them from view.

[0006] Posts are provided having a uniform square or rectangular flat-sided structure. The posts are formed of a tubular shell, preferably having a square or rectangular internal surface similar to the exterior surface. The shell has a relatively thin rigid wall and may be reinforced along its length by a plurality of internal frames. The frames are configured to engage the internal surfaces of the shell and slide along a central cylindrical core such as a pipe, which may be made of tubular steel or other strong material.

[0007] In erecting the posts, the core is solidly connected to the ground, a floor, a deck or other base structure. This can be done by conventional means by embedding the core pipe in concrete or other solid material, or by mounting the core pipe to a base with brackets and/or fasteners. A simple cap, such as a pyramidal closure or other decorative shaped cover may be attached to the top of the shell. The cap may snap on and slide off of the shell, and be interchanged with different cap configurations to modify the appearance of the assembly. The support frames are slidable along the length of the core pipe to allow adjustment of the frames to a desired height. One frame member may be positioned at the top of the pipe and one frame positioned at the bottom of the pipe. Once the frames are adjusted to the proper positions, the frames may be secured to the pipe. The outside of the frame means may either provide a conforming pattern to the internal cross-section of the shell or sufficient contact points with the shell to keep the shell oriented in a

predetermined position once that position has been selected and the frames anchored to the post. Anchoring can be accomplished in a variety of ways, such as by using bolts. The frames may be formed in two pieces that are connected around the core pipe in a clamp-like arrangement. Initially, the two frame pieces may be bolted together loosely to allow the assembled frame to be axially adjusted on the pipe and placed in proper position. Once the frame pieces are properly positioned, the bolts may be tightened to stabilize the frame in frictional engagement with the pipe.

[0008] The railing can be assembled by measuring the desired distance between posts and erecting the core pipes at desired locations. The lower frames are then positioned on the posts, and the shell is placed over the frames. Once the orientation of the shell is properly set, the lower frame is tightened in place. Upper frames may then be attached to the post and aligned based on the orientation of the lower frame and the shell. Once the upper frame is in proper position, it is tightened to the core pipe, similar to the lower frame. After the shell is installed over the frames, brackets may be anchored to the shell and frames with fasteners. In addition to anchoring the shell on the core pipes, the brackets are configured to support rails between posts.

[0009] When screws are used with brackets, the screws are placed in cylindrical openings in the brackets. A narrow shoulder may be provided on the interior of the openings at the inner most end. The cylindrical openings may be hidden or made less apparent by covers. The covers may be formed of resinous material and have a generally cup-shaped structure with cylindrical sidewalls. The sidewalls may be configured to fit snugly within the cylindrical openings. An end of each cover may conform to the exterior contours on the bracket to hide or minimize notice of the screw hole and cover.

[0010] In a second embodiment, railings are secured directly to posts through routed or punched openings that conform to the geometry of the rails. The rails assist in securing the shells in place on the posts. The rigid railing or fence panel arrays extend through the holes and are anchored between frames secured to the core to limit displacement of the shell.

[0011] In a third embodiment, a picket fence assembly is provided. A special resilient cleat made of resinous material attached at one end to horizontal fence or railing members is designed to fit within a tubular picket at a conforming hole. The cleat has a cam surface which acts as a latch to mount the picket to the rail. A number of cleats may be coupled with the rails to provide latching arrangements between the rails and a series of pickets.

Brief Description of the Drawings

[0012] The embodiments of the present invention may be better understood by reference to the accompanying drawings, in which:

[0013] Fig. 1 is a perspective view of a railing employing various structures in accordance with the present invention;

[0014] Fig. 2 is an exploded perspective view showing one arrangement for attachment of railings to posts using external brackets;

[0015] Fig. 3 is a drawing in section taken on the line 3-3 of Fig. 2 assembled and the internal structure of the post;

[0016] Fig. 4 is an enlarged exploded perspective exploded view of pieces of a support frame, several of which are seen assembled and in position in Figs. 2 and 3;

[0017] Fig. 5 is an enlarged perspective view of a first bracket variation mountable to a vertical post for receiving and supporting a handrail or other railing shaped with a specific cross-sectional shape;

[0018] Fig. 6 is a perspective view of a second bracket variation used for supporting a square lower rail of the railing structure in Fig. 1 on a flat vertical surface of a post;

[0019] Fig. 7 is a perspective view of a third bracket variation used for supporting a rectangular lower rail of the railing structure in Fig. 1 on the corner of a vertical post;

[0020] Fig. 8 is a perspective view of a fourth bracket variation for use in supporting a rectangular rail on the rounded exterior of a cylindrical post.

[0021] Fig. 9 is a cross-sectional view in partial section at the upper support frame taken along the line 9-9 in Fig. 10;

[0022] Fig. 10 is a partial sectional view taken along line 10-10 in Fig. 9;

[0023] Fig. 11 is a perspective view of a molded resinous screw cover designed to latch in a pop-in fitting on a bracket of the type shown in Figs 5-8 and Fig. 28;

[0024] Fig. 12 is a plan view from above the screw cover of Fig. 11;

[0025] Fig. 13 is a side elevation view of the screw cover of Figs. 11 and 12;

[0026] Fig. 14 is a front elevation view of the screw cover of Figs. 11-13;

[0027] Fig. 15 is an exploded perspective view showing a second arrangement for attaching railings to posts using routed or punched openings in one of the faces of the post shell;

[0028] Fig. 16 is a sectional view taken on the line 16-16 of Fig. 15, showing the post and railings of Fig. 15 assembled and the internal structure of the posts;

[0029] Fig. 17 is an enlarged exploded perspective view of pieces of a support frame, two of which are seen assembled and in position in Fig. 16;

[0030] Fig. 18 is a perspective view of an assembled railing in accordance with the structure seen in Figs. 15-17;

[0031] Fig. 19 is an exploded perspective view of a picket fence assembly showing an arrangement for attachment of railings to posts using external brackets and showing means of attachments of pickets to the railings;

[0032] Figs. 20 and 21 are perspective views from different angles showing the shape and nature of a resilient cleat attached to horizontal fence or railing members to permit easy attachment of individual pickets thereto;

[0033] Fig. 22 is a sectional view of the cleat of Figs. 20 and 21 showing the cleat in a position for attachment to a picket, similar to the position assumed in Fig. 25;

[0034] Figs. 23, 24, 25, and 26 are partial sectional views taken in a vertical plane through a railing and picket showing sequential steps in the attachment of the picket to the railing using the cleat of Figs. 20-22;

[0035] Fig. 27 is a perspective view of an assembled picket fence in accordance with the present invention;

[0036] Fig. 28 is a perspective view of a fifth bracket variation for use in supporting a rectangular rail and having an edge that may be customized to conform to the exterior shape of a supporting structure;

[0037] Fig. 29 is an exploded perspective view showing a frame variation for use in connecting external brackets to a post.

[0038] Fig. 30 is sectional elevation view of the support frame of Fig. 29 with railings connected with the support brackets.

[0039] Fig. 31 is a cross sectional view of the support frame shown in Fig. 29 in use with an optional channel member.

Detailed Description of the Preferred Embodiment

[0040] Referring first to Figs. 1-3, a railing assembly comprises a series of vertical posts with railing arrays extending horizontally between the posts. Each array includes one and preferably a plurality of horizontal rails. The arrays may be reinforced by vertical spacers secured between the rails. This embodiment illustrates different external brackets that can be mounted on posts 20 to produce an arrangement having a railing array 12 disposed at a 45° angle relative to adjacent flanking arrays 14 and 16. The post comprises a vertical support 36 enclosed within a hollow shell 20a. The shells 20a for the posts may be formed from extruded hollow square tubular shells, with peaked square pyramidal caps 18 closing the top of each shell. It will be appreciated, however, that other geometrical shapes and designs may be used for the shells and caps. The handrail arrays of the present invention are constructed from extruded hollow rigid parts of polyvinyl chloride resin (PVC), or other resin which is easily formulated, mixed and molded to the various cooperating pieces required from which then may be assembled into unitary railing

panels or arrays. One of the advantages of structures in accordance with this invention is that there are no exposed metal surfaces requiring painting or other maintenance. The exposed parts are either PVC, or parts covered with PVC, which are not prone to corrosion or other forms of deterioration associated with metal surfaces. Other types of resinous materials, as suggested, may be used. However, PVC has the advantage of being structurally strong and rugged, inexpensive, easily handled, and provides an attractive finish which does not have to be painted. It can be colored by additives. Additives may also be used to strengthen the PVC. In this case, where external brackets are employed, as will appear, the screws may be covered to protect the screws against corrosion and improve the aesthetic appearance of the assembly.

[0041] The external brackets are used to connect each railing array to a post 20. The brackets may be attached to the post by bolts, or other conventional means, as will appear hereafter. In Fig. 1, the assembled railing has a pair of end posts and a pair of intermediate posts. The end posts and intermediate posts are arranged relative to one another so that the square shells have the same orientation. Fencing arrays 14 and 16 have rails that abut flat surfaces on the post shells 20a. Therefore, the posts supporting arrays 14 and 16 have brackets 32 and 34, which are designed to fit on flat surfaces. The array 12 has rails that intersect corner edges on the intermediate posts. Therefore, the intermediate posts have brackets 22 and 24, which are designed to fit on a corner surface of the shell 20a.

[0042] Referring now to Figs. 2 and 3, the top rail 26 is configured as a guard rail, and the bottom rail 28 has a square or rectangular cross-section. A vertical spacer structure 30 connects the rails 26 and 28. The railing configuration may be pre-fabricated in arrays of standard lengths. Railing shapes and types may be designed to conform to standard cross-sections, and supporting brackets such as brackets 32 and 34 have openings designed to receive and support the ends of their respective rails, as seen in Figs. 2 and 3.

[0043] The support brackets 32 and 34 are configured to mount on a side face of a post, as discussed above. In particular, brackets 32 and 34 are designed to fit on flat surfaces of a standard post shell 20a. Bracket 32 is shown in more detail in Fig.

5, and bracket 34 is shown in more detail in Fig. 6. Railing arrays that are angularly offset from adjacent arrays, such as array 12 in Fig. 1, may require different brackets that mount on the corner of post shells. In Figs. 1 and 7, alternate brackets 22 and 24 are shown. Brackets 22 and 24 have V-shaped notches that conform to the surface contour of the corners on each post shell 20a. In this way, the brackets 22 and 24 are configured to mount flush against the corner of each post shell 20a. Other bracket configurations may be used to mount railings on different supporting structures. In Fig. 8, a bracket 74 is shown which has a rounded cut 76. The rounded cut 76 is configured to conform to the rounded exterior of a cylindrical column or other support structure with a circular curvature. In Fig. 28, a bracket 84 has a flat rear face 86 of sufficient depth so that may be cut and shaped in the field to conform to the geometry of a supporting structure. Both brackets 74 and 84 may include cylindrical holes 54 for receiving mounting screws, as will be described in more detail below.

[0044] The design of the vertical shells 20a is intended to produce high strength supports having a uniform appearance. Each post 20 has a high strength structural core 36 which may be formed of a variety of structural materials. For instance, the core 36 may be formed out of cylindrical steel pipe. The core 36 is configured to support one or more frames that may be mounted on the core to anchor the shells 20a to the core. The cores 36 may be supported in any conventional manner. For example, the cores 36 may be embedded in a concrete floor or deck. Alternatively, the cores 36 may be supported by attaching them through brackets to a wooden deck or floor which accepts screws or bolts to anchor the cores in place. The hollow, vinyl shell 20a may have a square cross-section, but can also be made in other shapes if desired. Whatever the shape, it is desirable to have a hollow inner surface that is uniform in its cross-section. The dimensions of the shell are otherwise determined by the scale of the actual fence or railing being supported. The space between the shell 20a and the core 36 may be bridged by a plurality of structured support frames.

[0045] Referring to Fig. 4, a two piece frame 38 is shown, comprising pieces 38a and 38b. The pieces 38a and 38b are preferably identical in configuration such that any two frame pieces are compatible with one another. The frames 38 are

preferably molded using a high strength material. As seen in Fig. 4 as well as Figs. 9 and 10, the two pieces 38a and 38b combine to form a tubular collar 40. The pieces may be connected to form the frame 38 using a variety of fasteners, including but not limited to screws, or nuts and bolts. In Figs. 9 and 10, the frame pieces are shown connected with a plurality of nuts and bolts 42. The nuts and bolts 42 are inserted through opposing vertical webs 44a and 44b on the frame pieces and threaded together to connect the frame pieces. The engagement between the nuts and bolts 42 may be adjusted to control the fit between the frame 38 and the core pipe 36. In particular, the nuts and bolts 42 may be connected in a loose setting to allow the collar 40 to slide axially along the core 36 and permit the frame to be set at the proper position on the core. Once the frame is properly positioned, the nuts and bolts 42 may be tightened to produce an interference fit between the tubular core 36 and the collar 40 to frictionally hold the frame 38 in a selected axial and rotational position on the core. Until the bolts 42 are tightened, the support frame 38 is rotatable about the core 36 to allow the shell 20a to be properly oriented. Referring now to Fig. 10, the support frame 38 is provided with a peripheral skirt 46 which conforms to the interior cross-sectional shape of the shell 20a. The skirt 46 is configured to slidably engage the interior surface of the shell 20a. The peripheral skirt 46 may have any geometry configured to slidably engage the interior of the shell. Preferably, the skirt's configuration engages the interior of the shell such that the orientation of the shell is stable and resists rotational displacement. The collar 40 and the outer skirt 46 may be connected by a horizontal web 48 divided into pieces 48a and 48b, as shown in Fig. 4. Reinforcing ribs connect between the peripheral skirt 46 and web pieces 48a, 48b to increase the rigidity of the frame 38.

[0046] As seen in Fig. 3, the support frames 38 determine the orientation of the post shell 20a. In assembly, the vertical core pipe 36 is first secured in place. In the specific case of the structure of Figs. 2 and 3, two support frames are arranged along the core pipe 36 in substantial alignment with the vertical position of the bottom rail 28. The two frames are inverted relative to one another and butted together to support the bracket for the bottom rail 28. After the two frames are adjusted to the correct level and rotated to the proper orientation, the collars 40 may be tightened against the core pipe 36 using the nuts and bolts 42. The shell 20a is

then placed over the frames. Once the shell 20a is in place, the upper support frame 38 is placed around the core pipe 36 and partially secured so that the frame is free to slide up and down the core pipe. The relative position of the upper frame 38 on the pipe 36 is adjusted until the position of the frame is generally aligned with the position where the railing will intersect the shell. Once the upper frame 38 is properly adjusted, the upper frame may be tightened in place. The brackets 32 and 34 can then be secured to the shell 20a using screws 50 and 52. Referring to Figs. 3 and 6, the bracket 34 is connected to the post shell 20a by four screws 50. The screws 50 are anchored into the shell 20a and the peripheral skirt 46 of the support frames. The bracket 32, as best seen in Fig. 5, is anchored by two screws.

[0047] It is noted that the frames are securely mounted on the upright core 36 to provide a firm lateral support for the shell 20a. The positions of the frames 38 in registry with the upper and lower rails 26 and 28 enables the brackets to be firmly supported by the core 36 and the frames 38 and to provide secure vertical support for the rails 26 and 28.

[0048] In some cases, it may be desirable to have one solid support frame along the length of the core. Referring to Figs. 29-31, a one-piece support frame 338 is shown which connects a shell 320 around a structural core element 336. The support frame 338 has a tubular section 340 and a plurality of support fins 342 extending radially outwardly from the tubular section. The tubular section 340 is adapted for sliding over the core 336. The support frame 338 may be inserted over the entire length of a core, or sections of the core. In Figs. 29-30, the support frame 338 extends along a substantial portion of the core 336 and is configured to permit the mounting of one or more brackets to the post structure. Since the one-piece support frame 338 extends along a substantial portion of the core element 336, brackets can be easily mounted to the support frame and column at almost any position on the post structure.

[0049] The tubular section 340 of the support frame 338 preferably contacts the exterior of the core 336 in a tight frictional engagement. The frictional engagement provides resistance against rotation so that the frame can be set to the proper orientation on the core and resist further rotation from incidental bumps during

installation. Frictional engagement may be provided in a number of ways. For example, the inner diameter of the tubular section may be substantially equal to the outer diameter of the core 336 so as to form a snug connection. Alternatively, the inner diameter of the tubular section 340 may include one or more longitudinal ribs 346, as shown in Fig. 31. The ribs 346 extend radially inwardly from the interior wall of the tubular section and frictionally engage the exterior of the core 336 to provide a snug fit. The support frame 338 may be secured to the core 336 by one or more fasteners, if desired. In Fig. 31, a screw 345 is mounted through the wall of the tubular section 340 and through the core 336 to secure the support frame 338 to the core. The support frame 338 is preferably extruded, but may also be formed from one or more molded components.

[0050] A corner flange 343 extends from the outward end of each support fin 342. The corner flanges 343 are configured to engage the inner wall of the shell 320 and provide a backing surface for mounting support brackets to the shell with one or more fasteners. In Figs. 29-30, the support brackets 332, 334 are mounted to the shell with a plurality of screws. Each screw extends through the shell 320 and into two separate sections of the support frame. More specifically, each screw extends through a corner flange 343 and a support fin 342, as shown in Fig. 31.

[0051] The interior wall dimensions of the shell 320 are slightly larger that the exterior dimensions of the support frame, providing a clearance space between the support frame 338 and shell. Preferably, the support frame 338 includes gaskets or friction elements 352 on the edges of the corner flanges. The friction elements are configured to extend through the clearance space and frictionally engage the interior of the shell 320 so that the shell fits snugly around the support frame. In this arrangement, the frictional engagement reduces the potential for rattling or incidental shifting of the shell around the support frame. The friction elements 352 may be formed of rubber or other flexible material. In addition, the friction elements 352 may be connected with the corner flanges by an extrusion process, an adhesive, or other technique.

[0052] Referring to Fig. 31, an optional channel member 350 may be inserted into the post structure to provide an additional backing surface for mounting support

brackets to the shell. The channel member 350 is disposed between adjacent corner flanges 343 and abuts the interior wall of the shell in a flush arrangement with the corner flanges. Like the support frame 338, the channel member 350 may be manufactured in different lengths and be inserted along the entire length of the core 336, or along sections of the core.

[0053] The support frame 338 may be installed as follows. After the core 336 is mounted to a base support, the support frame 338 is held over the core with the tubular section 340 aligned with the core. The support frame 338 is then lowered over the core and advanced down the core until the support frame is placed at the desired position on the core. Once in the desired position on the core, the support frame is rotated to the desired orientation corresponding to the desired orientation of the shell. At this time, a screw or other fastener may be inserted through the tubular section 340 and into the core 336 to fix the orientation of the support frame. The shell 320 is then slid down over the support frame 338 with the inner walls of the shell in alignment with the corner flanges 343 on the support frame. If desired, a channel member 350 may be inserted into the interior of the shell on the side where brackets will be mounted. The channel member 350 is inserted through the open top end of the shell and advanced downwardly into the shell between two of the support fins on the support frame. The top end of the post structure may then be closed with a cap to enclose and conceal the interior components of the post.

[0054] Referring to Figs. 5-8 and 28, the brackets 22, 24, 32, 34, 74 and 84 have sufficient depth to support a rail in a stable position between a pair of posts. The rails may be further stabilized by providing resilient spring sheet surfaces in the brackets, such as spring sheets 22a, 32a, 34a, 74a and 84a. The spring sheets are molded into the brackets and extend into the sockets that receive the ends of the railings. An integral web of resilient material is cantilevered from the frame wall so that the spring sheets extend inwardly toward the rail when the rail is received in the slot. The spring sheets are biased inwardly and impart inward pressure on the rail ends to produce a snug fit between the rails and the brackets.

[0055] Referring to Fig. 3, the screws 50 and 52 are mounted through the brackets 32 and 34 and driven into the frames 38 from the exterior of the shell 20a. It may be

desirable to cover the screws 50 and 52 so that the screws are protected from adverse elements, such as moisture, which can cause the screws to corrode. Covers may also be used to hide the screws, improving the aesthetic appearance of the assembled railing. Figures 11-14 show one embodiment of a cover 56 that may be used to cover the screws 50 and 52. The cover 56 is configured to be inserted in any of the mounting brackets of Figs. 5-8 and 28. The cylindrical holes for receiving the screws have all been similarly designated by number 54. The covers 56 shown in each of the drawings have cylindrical side walls 56a which are closed with a curved end wall 56b. The end wall 56b is configured to conform to the exterior contour of the bracket at each opening. As best seen in Fig. 12, each cover has at least one slot 56c which allows the side walls of the cover to flex inwardly as the cover is inserted into a hole 54. The covers 56 have a pair of tapered spring tabs 58. The tapered edges of the spring tabs 58 are configured to flex the side walls inwardly as the spring tabs engage the interior of the holes 54. Once the covers 56 are inserted in the holes 54, the resilient side walls of the covers bear outwardly against the interior of the holes to provide a snug fit. The holes 54 contain one or more tongue like projections 61 that conform to the shape of the slots 56c and mate with the slots as the covers are inserted into the holes. The bottom of the covers 56d are flat cylindrical surfaces which mate with flat cylindrical shoulders inside the hole so as to cover the screws in a flush engagement.

[0056] The exterior of the brackets 22, 24, 32, 34, 74 and 84 have a curved surface 53 surrounding the cylindrical holes 54. The surface 53 exhibits a compound curvature. For manufacturing economies, the curved surfaces 53 around every cylindrical hole 54 on each bracket have the same configuration, which conforms with the curvature of the surface of the end walls 56b of the covers 56. Thus, any cover 56 may be used with any one of the brackets to provide a substantially smooth and aesthetically pleasing appearance to the assembly.

[0057] Referring now to Figs. 15-18, an alternate embodiment of the invention is shown. In Fig. 15, a post 120 is shown having a shell with routed or punched openings 122 and 124 to receive rails 126 and 128, respectively. In most cases, the components that correspond to components in the previous embodiment are identified by the same reference numbers increased by 100.

[0058] Routed opening 122 is configured to conform to the shape of the handrail 126, and routed opening 124 is generally rectangular to accommodate the respective cross-sectional shape of bottom rail 128. Referring to Fig. 16, there is only one support frame 138 fixed in place near the bottom of the tubular core 136. The bottom frame 138 is aligned with the bottom of the routed hole 124 so that the frame and bottom edge of the hole provide vertical support to the bottom side of the rail 128. The rail 128 engages the sides of the routed hole 124 to prevent the shell 120 from moving axially relative to the core 136. Rails 126 and 128 are inserted directly into the routed holes 122 and 124, respectfully, and abut the tubular core 136. The upper support frame 138 is brought down into contact with the top of the handrail 126, thereby clamping the entire rail array or panel in place between the two support frames 138. If desired, additional screws may be anchored through the upper support frame 138 and into the rail 126 and/or into the core pipe 136 to further solidify and anchor the end of the rail structure. It may be desirable to insert the ends of the rails 126 and 128 through the routed openings after the lower support frame 138 has been secured on the core pipe 136 but before the upper support frame is secured on the core pipe. In this way, a relatively snug fit between the ends of the rail array and the core pipe 136 can be obtained. Referring now to Fig. 17, the same support frame construction is used as in Fig. 4. A completed assembly with routed rail supports is shown in Fig. 18.

[0059] Referring now to Figs. 19-27, a third embodiment of the invention is shown. This embodiment relates to a picket fence assembly. In general, components that correspond to components in the first embodiment are identified by the same reference numbers increased by 200. Referring to Fig. 19, external brackets 234 similar to those in the first embodiment are used to connect a pair of rails 59 to a post 220. The rails 59 may have any cross-sectional shape. In Fig. 19, the rails 59 are shown having rectangular shapes. The upper rail 59 and bracket 234 are secured to a pair of frames 238 through the shell 220. The bottom rail 59 and lower bracket 234 are secured to a pair of frames 238 in a similar manner.

[0060] In a preferred arrangement, individual pickets 64 are attached to both the top and bottom rails 59 using a spring cleat 60 cast from resilient polymeric resin. The cleat 60 has a simple configuration, as seen in Figs. 20, 21 and 22. In

particular, the cleat 60 consists of a body of molded resilient resin, preferably provided with a recess 60a in the back to minimize the weight and bulk and improve the flexibility while preserving the strength of the clip. A single hole 60b passes through the bottom of the cleat 60 and may be threaded if desired, as shown in Figs. 20 and 21. The cleats 60 are preferably attached to each of the rails 59 using a self-tapping screw 62. The cleats 60 are provided with a camming surface 60c. A channel 60d extends below the camming surface 60c. The upper edge of channel 60d is terminated below the camming surface 60c in a latching shoulder 60e. Once installed in the railing 59, the cleat 60 cooperates with the pickets 64 to hold them in place on the railing.

[0061] The pickets 64 may be installed after the rails 59 are connected between adjacent posts 220. Alternatively, the pickets may be pre-assembled to rails to form a panel or array which is installed as a unit between posts. Cleats 60 are attached to the upper and lower rails 59 at incremental spacings corresponding to the desired spacing between individual pickets 64. Referring to Figure 23, each picket has a pair of openings 66 and 66a. To connect the pickets 64 to the rails, the pickets are brought into position with the openings 66 and 66a facing the rails 59. The pickets 64 are then moved into position against the rails 59, as shown by the arrow in Fig. 23. Each picket 64 is placed over a cleat 60. The openings 66 in each picket 64 are adapted to receive the cleats such that the picket covers the cleats when assembled to the rails. The cleats 60 are configured to pass through the openings 66 in the pickets 64 and secure the pickets against each rail 59. After the picket 64 is placed over the cleats 60, as shown in Fig. 24, the picket is slid downwardly relative to the rail 59, as shown by the arrow in Fig. 25. As the picket 64 is slid downwardly relative to the rail 59, the camming surface 60c engages the interior of the picket. The camming surface 60c is tapered radially inwardly toward the top of the cleat such that the engagement between the camming surface and the interior of the picket displaces the cleat 60 outwardly and away from the rail 50a. More specifically, the tapered camming surface 60c contacts a bridge 66b between opening 66 and opening 66a on the picket. After the camming surface 60c passes over the bridge 66b, the resilience of the cleat 60 causes the cleat to snap back into its original position relative to the rail 59 so that the camming surface extends into the smaller

opening 66a, and the latch shoulder 60e engages the bridge 66b, as shown in Fig. 26. Since the pickets 64 attach to both rails 59 in the same way, the picket 64 may be attached to both rails in one downward movement. Subsequent pickets may be attached in sequence to the rails using pre-installed cleats 60 to form an array resembling a picket fence, as shown in Fig. 27.

[0062] The terms and expressions which have been employed are used as terms of description and not of limitation. There is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof. It is recognized, therefore, that various modifications are possible within the scope and spirit of the invention. Accordingly, the invention incorporates variations that fall within the scope of the following claims.